USSN 10/601,548
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Reply to Office Action mailed Nov. 23, 2005

REMARKS

The Examiners indication of allowable claims is noted with appreciation. However, it is noted that the Examiner has rejected claims 1, 2, 6, 10, 14, 15, 19, 19, and 20 under 35 USC 102 over Akiba. This rejection is respectfully traversed for the reasons set forth.

For clarity the term "background image" in independent claims 1, 9, and 19 has been replaced by the equivalent term "direct-reflection"image (please see page 4, line 12 for support). If an object is illuminated by an ordinary laser beam, the beam will reflect off the surface with an intensity representing the intensity of the scattering point. The net result is that CCD camera will capture an ordinary picture image of the object. However, if the object is scanned with a beam from a Michelson interferometer, in the region where the optical path difference between the reference beam and the sample beam is less than the coherence length of the light, known as the "coherence gate", the camera will not capture a recognizable image of the object, but instead will capture an interference image due to interference of the reference beam with the sample beam. Optical coherence tomography *per se* is well known technology.

In the novel process defined in the present invention, the inventor captures two different types of image, a first type, which is an ordinary direct-reflection image, and a second type, which is an interference image. As recited in the claims, the applicant captures at least one image of the first type and two images of the second type. The image of the first type requires that the optical path difference at the object be greater than the coherence length, so that no interference occurs, and the images of the second type require that the coherence gate be coincident with the layer being imaged in the object.

The applicant respectfully submits that the Examiner's rejection is based on a misreading of the teachings of Akiba. In particular, the Examiner states that Akiba teaches capturing a non-interference background image of the sample, and the Examiner refers to the first part of equation 4 on page 11, which relates to the first frame captured by the CCD, namely $C_1(x,y)$, which has exactly the same composition as the remaining two frames $C_2(x,y)$, and $C_3(x,y)$. Each of these frames is an <u>interference</u> image. $C_1(x,y)$ is not a background image as was recited in claim 1. They are all the same. There is no teaching in Akiba of capturing a direct-reflection image. On the contrary, Akiba extracts information from three images, $C_1(x,y)$, $C_2(x,y)$, and $C_3(x,y)$, all of which have the same form, and all of which are interference images.

It is noted in alleging anticipation the Examiner has recited only the first part of the equation describing the frame $C_1(x,y)$, namely $\frac{1}{4}\{I_s(x,y) + I_r(x,y)\}$, where I_s and I_r represent the intensities of the sample and reference beams. He has omitted the second part $\frac{1}{\pi}\sqrt{I_s(x,y)I_r(x,y)}\cdot\cos(\psi)$ $1/\pi$, which represents the interference component of the frames. In Akiba $C_1(x,y)$ is the image that is captured, not either of the components separately.

If the Examiner is suggesting that because the image captured in Akiba can be described <u>mathematically</u> as having interference and non-interference components, it is respectfully submitted that this is a rather absurd position to take. The absurdity of this position can be seen by considering, for example, a square wave having a certain repetition rate. Consider a claim that specified that an input must be a sine wave having a specified frequency. Supposing the prior art showed a square wave having a repetition rate equal to the specified frequency. The mere fact that the square wave can be considered <u>mathematically</u> as an infinite series of sine wave harmonics with a fundamental equal to the frequency of the sine wave surely could not by any reasonable standard be considered a disclosure of the use of a

sine wave as an input. One could also consider the example of a claim expressly specifying the use of an unmodulated signal. A modulated signal can be described mathematically as an unmodulated carrier with sidebands representing the signal, but that does not mean that the disclosure teaches an unmodulated signal.

Patent claims have to be interpreted with some measure of reasonableness. If one were to show a person an interference image $C_1(x,y)$ of an object, such an image would be unrecognizable to the human eye as being the object in question. That interference image cannot by any reasonable measure be described as a direct-reflection image of the object. It is noted that claim 1 recites capturing a direct-reflection image of the object. By any reasonable interpretation, that would mean that a person viewing such an image would recognize it as a direct-reflection image (or essentially a picture image) of the object. Akiba fails to teach this.

The applicants have described the interference image in equation 1 on page 4 as $I_0(x,y) = I_d(x,y) + A(x,y)\sin\varphi(x,y)$, wherein I_d(x,y) is the direct-reflection image. The basis of the applicant's invention is that this image is captured separately, and then used to solve the equations.

In order to avoid any possible misconstruction of rejected claims 1 and 9, the applicant has stated that the direct-reflection image is captured separately as a stand-alone image, as taught in the specification. (see, for example, page 8, line 12). That is the basis of the invention. In the above equation, I_d(x,y) is captured as a stand-alone image, not as a component of an interference image. In accordance with the teachings of the invention, with a knowledge of I_d(x,y), the equations can be solved. Despite the fact that the applicants do not believe the Examiner's apparent interpretation is reasonable, the intention is to make it clear that the direct-reflection image is not captured merely as a component of an interference image, as in the case in Akiba, who teaches capturing three images of the same type.

The method described in Akiba, which is based on the capturing of three interference images, $C_1(x,y)$, $C_2(x,y)$, and $C_3(x,y)$, all of which have the same form, imposes the restriction that there must be a constant phase difference of $\pi/2$ between them; otherwise the method of Akiba will not work. In practice, it is quite difficult to meet this condition, particularly when a depth scanning system is used. Such a restriction on phase angle does not apply to the present invention, which uses two interference images and one direct-reflection (i.e. non interference) image.

With regard to claims 3, 4, 7, 11, 12, 17, 18, and 21, the applicants respectfully challenge the Examiner's Official Notice, and put the Examiner to proof thereof. There is no evidence that the particular presentation of the equations set forth in the application is well known in the art. In particular, the representation of the image as consisting of a direct component $I_d(x,y)$ and in interference component is not directly disclosed in the art of record. Akiba does not indicate that the component ¼ $\{I_s(x,y) + I_r(x,y)\}$ based on the intensity of the sample and reflected beam could or should be considered as a single component $I_d(x,y)$ representing the direct reflection image.

Moreover, with regard to claim 3, for example, it is not obvious to solve the recited equation because there is no teaching in the art as to obtaining $I_d(x,y)$ other than as a component of an interference image as taught by Akiba.

Favourable reconsideration and allowance are respectfully requested.

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